NAVIGATION AND PAYLOAD SENSORS: INERTIAL NAVIGATION SYSTEM, ACCELEROMETERS, GYROSCOPES, GLOBAL NAVIGATION SATELLITE SYSTEM.
ELECTRONICS ASSOCIATED WITH THE DIGITAL MEASUREMENT CHAIN. ANALYSIS AND DESIGN OF INSTRUMENTATION. BUS SYSTEMS INSTRUMENTATION

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Outline:
The course is composed from lecture and workshop sessions introducing design and operation of a navigation system. Students usually develop their own one axe control loop of the spacecraft depicted in the figure. Topics covered by the course include following:

- Sensors, parameters and their applications
- Allan variance and sensor modeling
- Spacecraft sensors and systems
- Environment and electronics – magnetic and gravitational field
- Navigation algorithms and data processing
- Attitude control systems
- Digital communication (data buses)
- Introduction to the Small Satellite Platform and barometric formula
- Inner loops and reaction wheel control
- Magnetometer calibration and heading determination
- Accelerometers and body-to-navigation frame transformations
- Kalman filter
- Outer loop stabilization using
    - o Earth's magnetic field
    - o Angular rate sensors
    - o Star tracker sensors
- Sensor fusion and its usage for spacecraft stabilization

Small Satellite Platform used for the hands on exercises.

Hubble Space Telescope whose Attitude and Orbital Control System (AOCS) is introduced to students during hands on sessions of this course.

Simplified platforms – wireless inertial measurement units used during the course.